

Environmental Exposure and the Reproductive Health of Hispanic Women in Miami-Dade County, Florida

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Abstract

This project examines potential links between environmental hazards and women's reproductive health, with particular emphasis on fetal health and pregnancy outcomes in Miami-Dade County, Florida. Health data are derived from records of women seen at Jackson Memorial Hospital, University of Miami. The patient pool is predominantly urban and Hispanic and allows us to investigate environmental health issues important to this understudied minority population. This project will eventually examine in detail, through retrospective and prospective studies, the relationship of maternal, fetal, and neonatal (e.g., gestational age, birth weight) outcomes to a variety of point and non-point source environmental exposures. We will also consider confounding socioeconomic variables (e.g., income, health care delivery system used, and cost of medical care). At this initial stage, we are using a geographic information system (GIS) framework and data from EPA's Toxic Release Inventory and the Metro-Dade County Environmental Resources Management Agency to analyze patient exposure risks to point source environmental hazards (e.g., industrial facilities, private wells, petroleum storage sites). Environmental justice issues related to environmental exposure risks are of particular concern in Miami-Dade County at this time. An urban core redevelopment project, "Eastward Ho!," seeks to revitalize and improve quality of life in Southeast Florida's historic, urban areas and simultaneously lessen development pressures and urban sprawl in sensitive environmental lands to the west, including the Everglades ecosystem. This program, however, has also generated concerns about public health effects of utilizing brownfield (contaminated/ remediated) sites for urban in-fill. Our project will contribute to this critical discussion by providing information on the relationship between reproductive health and environmental risks within the urban core.

Keywords: environmental justice, reproductive health, Hispanic

Introduction

We are interested in the potential health risks to pregnant women and their fetuses in the predominantly Hispanic, urban population of Miami-Dade County due to exposure to environmental hazards. Patient data will be derived from the patient pool at Jackson Memorial Hospital, a large, metropolitan teaching hospital affiliated with the University of Miami. While obstetrics patients are routinely screened for a variety of common medical/obstetrical and psycho/social risk factors, they undergo no screening for any environmental risk factors. Here we describe the preliminary

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planning phase of our study, which will incorporate patient information and environmental data into a geographic information system (GIS) for analysis.

Population at Risk

Miami-Dade County Population

The population of Miami-Dade County is predominantly urban and unique in its high proportion of Hispanic individuals and large number of recent immigrants, originating primarily from the Caribbean but also from a variety of Latin American countries. While the population of the county shares some of the general characteristics of immigrant and Hispanic populations in the United States, demographic and socioeconomic measures vary significantly across Miami-Dade's ethnic groups and within ethnic groups depending in part on the time since arrival in the United States.

Hispanics make up 52% of the county's population, with other minorities (African Americans, Haitians, Native Americans, and Asian Americans) comprising another 22%. Foreign-born and native-born Cuban Americans make up the largest proportion (approximately 50%) of Hispanics in the county. There are also large populations of Puerto Ricans, Colombians, and Nicaraguans. Approximately 60% of the county's population is foreign-born (1).

Although Miami-Dade County is predominately Hispanic, on average, it reflects closely the age and fertility patterns of the US in general. However, average demographic figures may mask significant within-group variation in the county. For example, foreign-born Hispanic women tend to have higher fertility rates and lower educational levels (2). In addition, the relatively large illegal immigrant population in the county may differ in fertility and age structure from the legal population upon which reported demographic measures are based. Average educational achievement level is one variable for which Miami-Dade County falls below the national average (65% and 82% high school graduate or higher, respectively) (1).

Jackson Memorial Hospital Obstetric Pool

As a metropolitan public hospital, Jackson Memorial serves a high-risk population of obstetrics patients. They represent the working poor, and the majority of patients depend on some form of public assistance. Patients are disproportionately ethnic minorities even relative to the overall county population. Patients who tend to be less educated and from lower income groups are less likely to obtain appropriate care prior to the delivery of their infants (3). Poor, young minorities are disproportionately uninsured (3). We feel they are also less likely to be aware of potential environmental health hazards.

Current data (January to June 1998) indicate that, while most mothers delivering at Jackson are between the ages of 20 and 39, 16% are age 13 to 19. Seventy-two percent of the women report themselves to be single parents. The majority of mothers begin prenatal care in the first trimester of pregnancy; however, 5% do not receive care until the third trimester and 10% report no prenatal care before delivery.

Residence within the urban core may lead to higher levels of exposure to environmental hazards and to exposure to different environmental hazards than the population at large. It is now well established that the potential impact of environmental hazards

is not uniform (4). Socioeconomic status and ethnicity are among the factors that make some groups more vulnerable to the adverse health effects of environmental pollutants (5). This is the primary concern of the field of environmental justice, which has found that hazardous waste sites are disproportionately located in minority communities (6), that air pollutants are disproportionately released in minority, especially Hispanic, communities (7), and that average penalties incurred by polluters are substantially lower in minority communities (8). Despite this potential for greater exposure among Miami-Dade's minority, urban core population, identification of environmental risk factors and detection of mother/fetal exposure and consequence are currently unmonitored within the Jackson Memorial obstetric patient pool.

Environmental Hazards to the Fetus

Unfortunately, though the perinatal period is recognized as a sensitive period of life, it is also understudied and there are few data available on the adverse reproductive and developmental effects of most environmental agents. Government policy does not specifically identify the fetus as a potentially vulnerable individual despite the fact that the fetus and the newborn differ biologically from adults.

Although there are many similarities between intra- and extrauterine exposures, there are notable differences as well. The fetus is at risk, first, through the increased basal metabolic rate of pregnant women who have increased minute ventilation and oxygen consumption, which increases their risk of exposure to air pollutants (9). Because of increased basal metabolic rate and accretion of new tissue, pregnant women have an increased caloric requirement, which increases their risk of exposure to pollutants in food and water (9).

Second, the fetus differs from the adult in modes of potential exposure. For instance, the skin of the fetus is underkeratinized, reducing the barrier properties of this tissue. The ability to metabolize various chemicals depends on developmental stage. Perhaps most importantly, fetal organs are in the process of growth and differentiation, which increases their vulnerability to harmful agents (9).

A pregnant mother's environment and her health behaviors are important determinants of fetal exposure. Fetal exposure to lead is dependent on both current and past maternal exposures to the element. Lead accumulates in the bones over time; this accumulate is mobilized from maternal bones during pregnancy and can result in elevated fetal lead levels (10,11). For this reason, lead exposure should be minimized and monitored in young women in order to avoid future fetal exposures.

The primary route of fetal exposure to methyl mercury is parental consumption of contaminated fish. Subsistence fishing with its risk of exposure to methyl mercury, PCBs, and other chemicals is a major environmental justice concern in the state of Florida (12,13). As reported by the Florida Public Interest Research Group in 1998, Florida ranks 12th in the country in mercury emissions from coal- and oil-burning power plants. This mercury then contaminates both inland and coastal bodies of water. Because of bioaccumulation, locally caught fish can contain as much as 100,000 times the concentration of mercury in the surrounding water.

The health consequences of perinatal exposure to dioxin and related compounds have prompted a World Health Organization risk assessment initiative (14). Dioxin-like compounds are known to transfer, although incompletely, across the placental barrier

to the fetus. Developmental abnormalities and neuro-behavioral deficits have been identified in children whose mothers consumed PCB-contaminated cooking oil and organochlorine-contaminated fish during pregnancy (15,16,17,18).

The hormonal effects of pesticides have obvious reproductive and developmental consequences. The in-utero endocrine effects of vinclozolin have been well documented. It acts as an anti-androgen and, as a pesticide residue in food, it may have developmental consequences in fetuses and children who are potentially sensitive to imbalances in hormone levels (19,20). Organochlorines, a group of widely used chemicals, have been implicated in endocrine related events in alligators living in Lake Apopka in Central Florida (21). DDT has been spilled in these areas and the effects are considered to be due to DDE, a potent metabolite of DDT, which leads to an imbalance between androgens and estrogens and causes abnormal sexual development. DDT and DDE, which have a well-documented lactation suppression effect, and vinclozolin are classic examples of endocrine disrupters that can cause abnormal pregnancies, endometriosis, and increased risk of breast and prostate cancer (22).

Environmental Hazards in Miami-Dade County

We have begun to incorporate information and data pertaining to both point source and non-point source reproductive and developmental hazards in Miami-Dade County into a GIS database (zip code and street address linked). Our primary point source database is the US Environmental Protection Agency's annual Toxic Release Inventory (TRI) monitoring database. These data provide information on air and water releases from monitored facilities occurring in Miami-Dade County. Though the TRI data do have recognized limitations, we have used the Environmental Defense Fund's (23) lists of recognized and suspected reproductive and developmental toxins together with existing TRI data to identify facilities within Miami-Dade County that release these substances (Tables 1–3). We can see from preliminary plotting of these TRI sites and 1997 Jackson Memorial obstetrics patient residence by zip code that our patient pool lives in relatively close proximity to these sites (Figure 1). We also have access through the Dade County Environmental Resource Management Agency to data on additional local facility releases (e.g., underground tanks, dry cleaners) that are not included under the TRI system.

Non-point source exposures may be of equal or greater health importance than point source releases. In addition to specific information acquired through our patient survey, we will incorporate into our GIS database information on drinking water sources (public, private commercial, and individual well systems) and age of housing, which can influence the likelihood of exposure to lead through plumbing and paint.

Proposed Study

Our goal is to collect environmental risk data on individual mothers through questionnaires, then link these data to pregnancy outcomes and an environmental hazards database. All pregnant women presenting for prenatal care at the obstetrical service of Jackson Memorial Hospital will be offered a questionnaire that screens for environmental health issues. All interviews will be conducted one-on-one with the patient in a

Table 1 USEPA Toxic Release Inventory Data (1995): Recognized Developmental Toxicants Released in Miami-Dade County, FL (23)

Chemical	Releases to Air (lb)
Toluene	440,919
Arsenic	10

Table 2 USEPA Toxic Release Inventory Data (1995): Suspected Developmental Toxicants Released in Miami-Dade County, FL (23)

Chemical	Releases to Air (lb)
Trichloroethylene	141,495
Styrene	136,295
Tetrachloroethylene	82,000
Phenol	67,004
Xylene (mixed isomers)	8,550
Methyl ethyl ketone	1,827
Methyl methacrylate	985
Glycol ethers	510
Methyl isobutyl ketone	250
Copper	22

Table 3 USEPA Toxic Release Inventory Data (1995): Suspected Reproductive Toxicants Released in Miami-Dade County, FL (23)

Chemical	Releases to Air (lb)
Toluene	440,919
Dichloromethane	371,714
Trichloroethylene	141,495
Tetrachloroethylene	82,000
Xylene (mixed isomers)	8,550
Methyl ethyl ketone	1,827
Methyl methacrylate	985
Glycol ethers	510
Copper	22
Arsenic	10

private setting. The questionnaire will focus on the following aspects of environmental exposure hazards:

- **Water:** Source and consumption patterns.
- **Lead exposure risks:** Age of housing/plumbing.
- **Mercury exposure risks:** Fish consumption patterns, source of fish consumed.
- **Occupational exposure risk:** Occupation information on patient and primary household members.

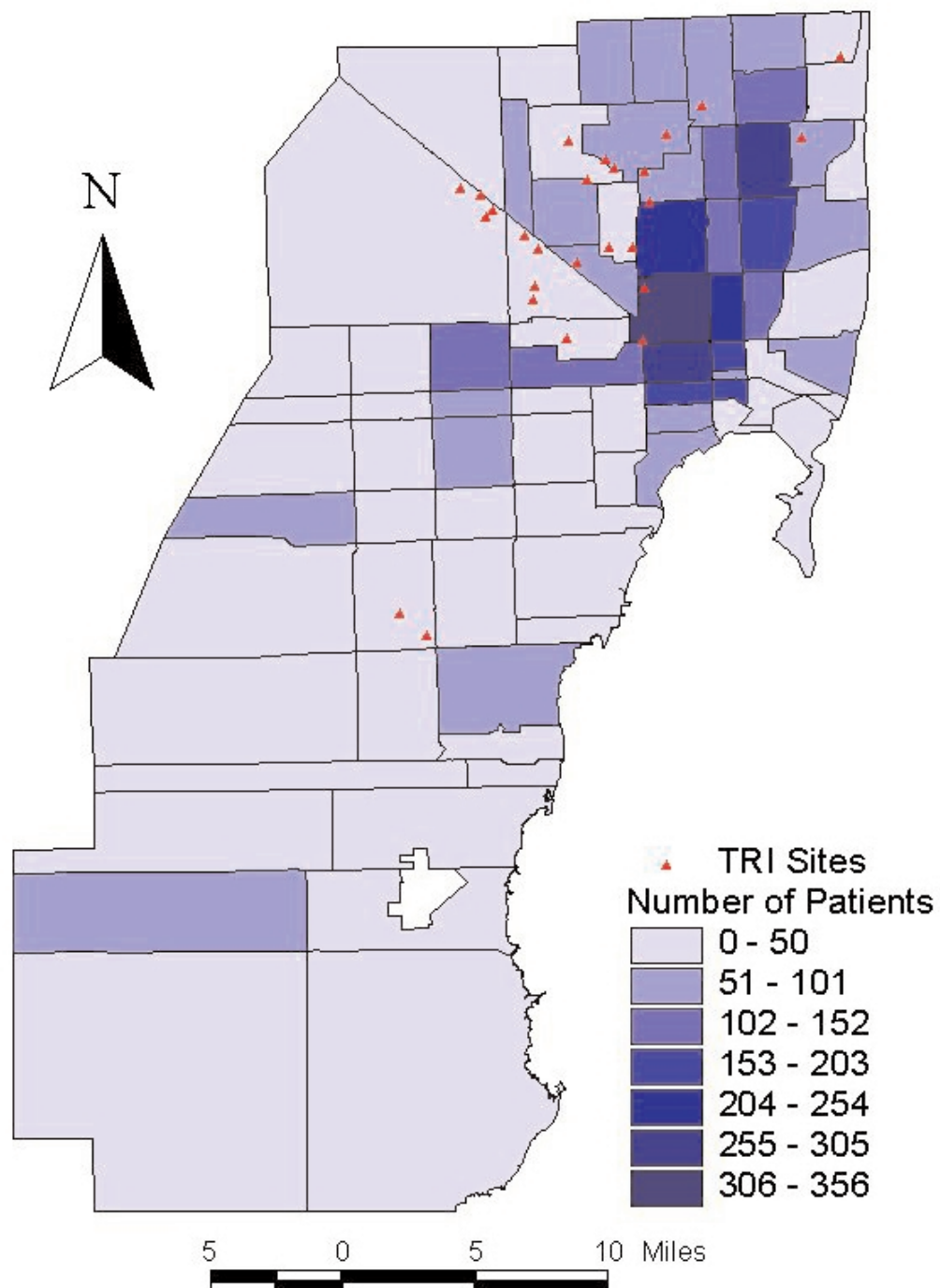


Figure 1 Location of TRI sites releasing known and suspected reproductive and developmental toxins, and 1997 Jackson Memorial Hospital obstetrics patient residence by zip code in Miami-Dade County, FL.

- **Pesticide exposure risk:** Known use of pesticides/herbicides in and around the home.
- **Personal lifestyle risk factors:** e.g., smoking habits of patient and primary household members.

Our assessment of pregnancy outcomes will include a number of variables not readily available in the literature. For each mother, we will record antenatal course, medical risk factors, abnormalities in fetal growth and tests of fetal well-being, gestational age at labor, duration and progress of labor, mode of delivery, indications for operative delivery, hospital course, number of days in hospital, and discharge diagnosis. For each birth, we will also record gestational age at birth, birth weight, number of days in the hospital, stay in normal newborn nursery versus neonatal intensive care unit (days on respirator, treatment modalities), age at discharge from hospital, and discharge diagnosis when other than a normal newborn. In addition, we hope to collect and analyze matched mother/fetal blood samples for assessment of critical risk factors such as lead, mercury, various organochlorines, and indicators of endocrine disruption.

We plan to explore further environmental risk and pregnancy outcome patterns through the development and use of a countywide GIS database. We plan to include the following data:

- EPA TRI annual facility release data
- Superfund site locations
- Other county data on non-TRI release facilities
- Public and private drinking water sources
- Jackson Memorial Hospital obstetrics patient outcome data

This database and the GIS format will allow us to plot potential environmental hazard sources as well as known pregnancy outcomes for surveillance purposes. This approach is critical to beginning to assess spatial distribution of negative pregnancy outcome patterns and their potential relationship with known and suspected reproductive and developmental hazards. This analysis is of particular interest from the perspective of environmental justice in the urban, minority population of Miami-Dade County.

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